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AT5K 3500 Watt Antenna Tuner

Owner's Manual

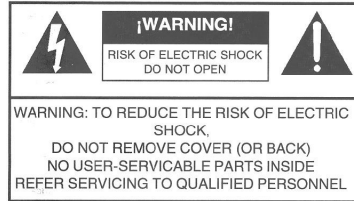


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WARNING: TO PREVENT FIRE OR ELECTRICAL SHOCK DO NOT EXPOSE TO RAIN OR MOISTURE



An appliance and cart combination should be moved with care. Quick stops, excessive force and uneven surfaces may cause the appliance and cart combination to overturn.



The lightning flash with arrow head symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE. DO NOT OPEN THE CABINET WHILE OPERATING. REFER SERVICING TO QUALIFIED PERSONNEL ONLY.

CAUTION: TO PREVENT ELECTRIC SHOCK, DO NOT USE THE THREE WIRE CORD WITH AN EXTENSION CORD RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

1. Read Instructions—All the safety and operating instructions should be read before the appliance is operated.

2. Retain Instructions—The safety and operating instructions should be retained for future reference.

3. Heed Warnings—All warnings on the appliance should be adhered to.

4. Follow Instructions—All operating and use instructions should be followed.

5. Cleaning—Unplug this appliance from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

6. Do Not Use Attachments—not recommended by the manufacturer or they may cause hazards.

7. Water and Moisture—Do not use this product near water—for example, near a bathtub, wash bowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool—and the like.

8. Accessories—Do not place this product on an unstable cart, stand, tripod, bracket, or table. The product may fall, causing serious injury to a child or adult, and serious damage to the appliance.

9. Ventilation—This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation such as a bookcase or rack unless

proper ventilation is provided or the manufacturer's instructions have been adhered to. Any slots or openings in the cabinet are provided for ventilation. To ensure reliable operation of the video product and to protect it from overheating, these openings must not be blocked or covered. The openings should never be blocked by placing the product on a bed, sofa, rug, or other similar surface.

10. Grounding or Polarization—this product is equipped with a 3-wire line cord receptacle. It is intended for use with a 3-wire properly grounded power socket. Do not defeat the safety purpose of the supplied line cord and plug.

11. Power Sources—This product should be operated only from the type of power source indicated on the marketing label. If you are not sure of the type of power supplied to your home, consult your appliance dealer or local power company.

12. Power-cord Protection—Power-supply cords should be routed so they are not likely to be walked on or pinched by items placed upon or against them. Pay particular attention to cords at plugs, convenience receptacles, and the point where they exit.

13. Lightning—For added protection for this product during a lightning storm, or when it is left unattended and unused for long periods of time, unplug it from the wall outlet.

14. Power Lines—An outside antenna system should not be located in the vicinity of overhead power lines, other electric light or power circuits, where it can fall into such power lines or circuits. When installing an outside antenna system, extreme care should be taken to keep from touching such power lines or circuits as contact with them may be fatal.

15. Overloading—Do not overload wall outlets and extension cords as this can result in a risk of fire or electric shock.

16. Object and Liquid Entry—Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short-out parts that could result in a fire or electric shock. Never spill liquid of any kind on the product.

17. Servicing—Do not attempt to service this product yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.

18. Damage Requiring Service—Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

- a. When the power-supply cord or plug is damaged.
- b. If liquid has been spilled, or objects have fallen into the product.
- c. If the product has been exposed to rain or water.
- d. If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions. An improper adjustment may result in damage and will often require extensive work by a qualified

technician to restore the product to its normal operation.

e. If the product has been dropped or the cabinet has been damaged.

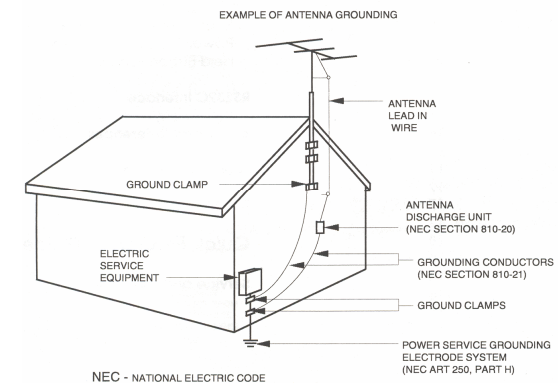
f. When the product exhibits a distinct change in performance—this indicates a need for service.

19. Replacement Parts—when replacement parts are required, be sure the service technician has used replacement parts specified by the manufacturer or have the same characteristics as the original parts. Unauthorized substitutes may result in fire, electric shock or other hazards.

20. Safety Checks—Upon completion of any service or repairs to this product, ask the service technician to perform safety checks to determine that the product is in proper operating condition.

21. Outdoor Antenna Grounding—Before attempting to install this product, be sure the antenna or cable system is grounded so as to provide some protection against voltage surges and built-up static charges.

- a. Use No.10 AWG copper, No.8AWG aluminum, No.17AWB copper-clad steel or bronze wire or larger, as ground wire.
- b. Secure antenna lead-in and ground wires to house with stand-off insulators spaced from 4 feet to 6 feet apart.
- c. Mount antenna discharge unit as close as possible to where lead-in enters house.
- d. A driven rod may be used as the grounding electrode where other types of electrode systems do not exist. Refer to the National Electric Code, ANSI/NFPA 70-1990 for information.
- e. Use jumper wire not smaller than No.6 AWG copper or equivalent, when a separate antenna grounding electrode is used.



Thank you for purchasing a Palstar AT5K Antenna Tuner. This antenna tuner has been designed and manufactured to high quality standards, and will provide reliable operation for many years.

Please carefully read the Owner's Manual in order to take advantage of the many interesting features that will provide years of enjoyable amateur radio operation.

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Limited Warranty

Palstar Inc. warrants products manufactured by it to be free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of delivery to the first buyer (the "Warranty Period"). Palstar Inc's obligation under this warranty is limited to repair or replacement of the product; at its option at the Palstar factory in Piqua, OH.

Effective only when the product is returned to the factory with all transportation charges prepaid and examination of the product discloses in Palstar's judgment, to have been defective during the Warranty Period.

The Warranty Period shall not extend beyond its original term with respect to interim in-warranty repairs by Palstar. This Warranty Period shall not apply to any product which has been repaired or altered by anyone other than Palstar without prior written authorization. Warranty does not extend to any products which have been subject to damage from improper installation, application or maintenance in accordance with the operating specification. Palstar neither assumes nor authorizes any person to assume for it any obligation or liability other than herein stated.

Repair Policy

When sending in a product for service, please include a note clearly describing the problem, how you wish the item returned and how you wish to pay for the service. Our service rate is \$30 per hour (1/2 hr. minimum).

Return Policy

All returns must receive prior authorization from Palstar. Returned items must be received in original—AS SHIPPED—condition including the original box, manuals, accessories, and copy of sales receipt. Returns must be within 14 days of purchase. Returned items are subject to a 25% restocking fee. Shipping is not refundable.

NOTE:

Keep the packing your AT5K was shipped in case a return for repair is necessary.

If you ship the tuner in other than the original packing, Palstar cannot be responsible for shipping damage, and you will be charged \$25 for replacement packing when we return it to you.



The Palstar AT5K Antenna Tuner is an American made impedance matching network that can provide unbalanced and balanced output with a power rating of 3500 watts (single tone continuous) and 5000 watts PEP at certain Z ranges (p.14).

The AT5K T-matching network utilizes a 1:1 unbalanced to balanced transformer in the input of the network. When the network is properly tuned, a 50 Ohm impedance will be presented to both the input and output of the balun for maximum efficiency.

The AT5K optimizes the performance of your antenna and transmitter by providing adjustable impedance matching using a T-type circuit configuration. The AT5K also measures the power and Voltage Standing Wave Ratio (VSWR) which al-

lows you to tune the SWR to the lowest ratio for the selected transmission frequency.

Integrated into the AT5K is a frequency-compensated lighted-dial dual-movement SWR meter. The meter features the ability to read True Active Peak and Peak Hold.

Designed to handle both Balanced line feeds and Coax feeds the AT5K features a front panel mounted switch to select between feeds.

Tuning is achieved with the front panel mounted controls. The Vernier capacitor dials allow for tuning with precision and accuracy, while the Inductor crank handle facilitates coarse adjustments.

Unpacking

Carefully remove the AT5K from the shipping carton and inspect it for signs of damage. If any damage is apparent, notify the transportation carrier or dealer immediately. **We recommend keeping the packing carton for moving, storing or reshipping the tuner to us for repair if required.**

Location

Select a location for the AT5K that allows the connectors to be free from any possible contact with people, pets, or objects during operation and with unrestricted air flow for cooling.

Installation Procedures

Connect a coax cable from your transmitter to the RF INPUT connector on the rear panel. Keep the cable as short as possible. If you use a linear amplifier, connect your transmitter to the linear amplifier input and the linear amplifier output to the AT5K.

Connect coax cable from your antenna to the COAX 1 or COAX 2 connector on the rear panel. These connectors are either direct from the transmitter or through the tuned circuit, depending on the setting of the OUTPUT SELECTOR switch on the front panel.

For coax feed (unbalanced) the BALANCED/COAX switch on the front panel must be in the OUT position. This grounds the lower end of the roller inductor, allowing coax feed.

For a balanced feed antenna connect a balanced feed line to the white BALANCED OUTPUT posts (back panel). Note that for balanced operation, the BALANCED/COAX switch on the front panel must be in the IN position, and an LED above the switch will light, indicating balanced feed.

Connect a dummy load to the BYPASS connector using a coax cable. This lets you select the dummy load from the DIRECT/TUNED mode switch. Any antenna that does not require the use of an antenna tuner may be connected to the BYPASS connector, if desired.



WARNING: Balanced antennas will produce high RF voltages at the output post connectors. RF burns may result if touched during transmission.

Front Panel Indicators and Controls

Metering Dual movement cross needle power and frequency compensated coupler

Controls

Input Tuning Variable capacitor (600 pF, 6kV Peak)
 Antenna Tuning Variable capacitor (600 pF, 6kV Peak)
 Inductance 35 μ H roller inductor 10 ga. plated copper wire rated at 10 amps and 5kV
 Antenna Selector Switch 6 position: Coax 1 tuned and tuner bypass;
 Coax 2 tuned and tuner bypass;
 Bypass coax connector;
 Balanced antenna
 Switch wafers are ceramic (7kV/10A rated)
 Power Range Switch 2 position 300 W /3000 W

Rear Panel Connectors

Coax SO239 connector (silver/gold/TFE)
 Balanced Line Dual High Voltage Nylon66™ terminal post
 12 VDC Input For meter light and relays -- 2.1mm conn. (center +)

Other

Frequency Coverage 1.8 — 29.5 MHz
 Power Maximum 5000 W PEP SSB, 3500 W single tone continuous
 Impedance Range 10 to 2000 Ω NOTE: Power Range p.14
 Balanced Output 1:1 current type Balun at input-Ferrite
 Dimensions 16" Wide x 8" High x 18" Deep (incl. terminals)
 Weight 25 lbs.
 Materials Chassis, brackets, and top cover are gold chem-film coated aluminum (.090) & powder coated.
 Front Panel Front panel is matte powder coated and screened.

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4. Any time a new or different antenna is connected, it is necessary to repeat the tuning procedure for the new antenna.

Troubleshooting

You hear a spitting sound while tuning your AT5K at high power.

You are probably tuning into an impedance that is on the low side ($20\Omega - 40\Omega$). In this event, either reduce transmitter/amplifier power to a lower setting or change to a higher antenna impedance by using a different antenna or modifying the existing antenna.

Also, try to find the highest capacitance setting (i.e. closer to 100 on the dial) on the output knob. This will probably require re-adjustment of the inductance setting.

An antenna capacitance setting that is too low under these conditions will result in excessively high voltages, high losses, and poor efficiency.

Output Cap	Inductor	Voltage	Loss
100pF	11.7 μ H	4550	16%
200pF	6 μ H	2400	8%
300pF	4 μ H	1600	6%

For example: at 1500 Watts into a 25Ω load @ 3.5Mhz will produce the following:

In the first instance the tuner will arc and suffer almost 16% loss of which 80% will be dissipated in the roller inductor.

Power Specifications (assuming single tone key down)	
Antenna Impedance	Max Power Rating
8 $\Omega - 15 \Omega$	1000 watts (all bands)
15 $\Omega - 25 \Omega$	1500 watts (all bands)
25 $\Omega - 50 \Omega$	3500 watts (all bands)
50 $\Omega - 2000 \Omega$	160M — 3500 watts 80M - 15M—3500 watts 10M — 1500 watts (29.5 MHz max)

Rear Panel Description 7

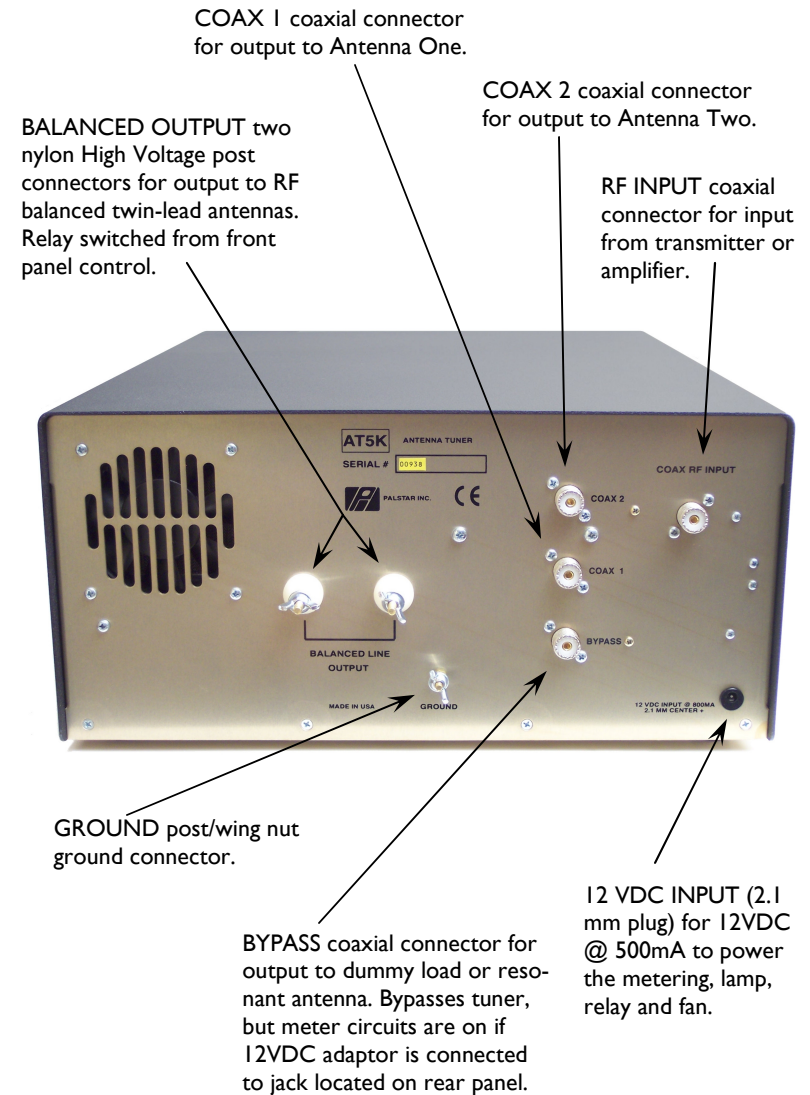
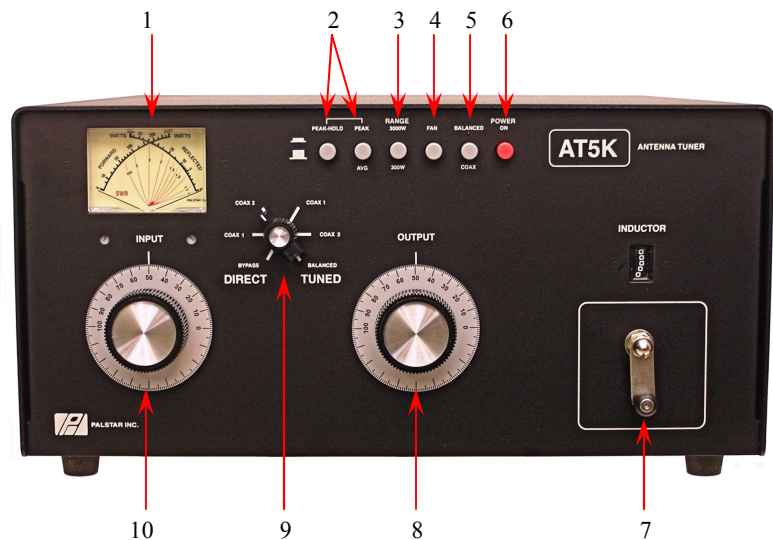


FIGURE 1 REAR PANEL CONNECTORS

8 Front Panel Description



- 1. POWER/SWR METER** Dual needle meter displays FORWARD and REFLECTED power in watts. SWR is measured where the two needles intersect on the red scale.
- 2. PEAK AND PEAK/HOLD** Active circuitry is used to offer peak reading for SSB. This peak feature is also translated to provide an approximate 2 second hold at the peak level for easy viewing. NOTE: The PEAK/HOLD will function only if the PEAK button is pressed in as well.
- 3. RANGE** The power range is 300 watts on low and 3000 watts on high (push button in for high).
- 4. FAN** The IN position turns on the fan which cools the internal components of the tuner when using a service that requires constant carrier operation (for e.g. AM or RTTY).
- 5. BALANCED/COAX** Selects either coax feed or balanced feed. A LED shows when balanced mode is selected.

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7. Key your transmitter and adjust the power level for a reading of 100-150 watts on the FORWARD scale. Adjust the INPUT, OUTPUT and INDUCTOR controls for a minimum REFLECTED reading while maintaining a FORWARD reading of 100-150 watts using your transmitter power control. Use the supplied chart of approximate tuning control locations for the different bands located at the back of the manual.
8. Read the SWR on the red scale at the point where the two needles intersect. Repeat TUNING the input and antenna controls until the lowest SWR reading is obtained.

CAUTION: When approaching the end stops of the roller inductor, (readings of Zero or 229) **SLOW DOWN**. Slamming the roller wheel into the mechanical end stops on either end of the roller inductor can damage it.

This procedure takes patience the first time. The input and antenna controls vary the capacitors and provide fine adjustments. The roller inductor crank control provides coarse adjustment.

9. When you have tuned your antenna to the best SWR, record the settings of the INPUT, ANTENNA and INDUCTANCE controls on the chart above for future reference. When you retune, use these settings as your starting point.

Notes

1. An SWR of 1:1 is best, but an SWR as high as 2:1 may be acceptable. Check your transmitter/amplifier manual for details.
2. If you cannot get an acceptable SWR, lengthen or shorten your antenna and/or feedline and retune.
3. Very high or very low impedance loads are to be approached with extra caution especially when you are going to use high power and the use of an RF analyzer (e.g. the Palstar ZM30 Antenna Analyzer) would be advisable to check and understand the kind of load you attempting to use.
4. If you get low SWR readings at more than one setting, use the setting that gives:
 - highest FORWARD power reading
 - lowest REFLECTED power reading
 - uses the largest capacitance (highest number) on the OUTPUT control.

It is important to remember that consistent with low SWR indicated on the tuner meter you must have and adjust for the largest capacitance (highest number) on the output control to keep the losses low and the voltage that would appear on the antenna capacitor within the 5kV rating;

If you hear a spitting sound while tuning at high power you are probably tuning into an impedance that is on the low side (20Ω - 40Ω). Please see the troubleshooting section for more detailed instructions.

Before Operating

1. To avoid possible damage to the AT5K set INPUT, OUTPUT, INDUCTOR, and POWER RANGE switches as outlined in the chart before applying transmitter power.
2. Begin tuning with your transmitter/lamp into the tuner set at a low output power setting (50-150 Watts).

Tuning



WARNING: DO NOT OPERATE THE AT5K WITH THE COVER OFF.

1. Select the band and frequency of desired operation.
2. Set TUNE and INDUCTOR controls to the suggested setting before applying transmitter power (see chart). Actual settings will vary from antenna to antenna.
3. Set your transmitter/amplifier to a low power output (100-150 watts). If your transmitter/amplifier combination has a LOW POWER position, select that position to obtain the 100-150 watts for the initial tune-up.
4. Preset the INPUT, OUTPUT, and INDUCTOR values shown in the chart supplied for each band or on the label on the front panel. Select the type of antenna feed you require (BALANCED or COAX) with the pushbutton on the front panel. Note: BALANCED shows red LED.
5. Set the POWER RANGE switch to 300 W (with POWER range switch meter button out).
6. Set the OUTPUT SELECTOR switch to the position matching your antenna connection. To tune your antenna, the switch selection must be set to: COAX 1 TUNED, COAX 2 TUNED or WIRE (BALANCED ANTENNA). Selecting COAX 1 DIRECT, COAX 2 DIRECT or BYPASS bypasses the tuning selection.

BAND	INPUT		OUPUT		INDUCTOR	
	SUGGESTED	ACTUAL	SUGGESTED	ACTUAL	SUGGESTED	ACTUAL
160 M	32		32		20	
80 M	31		33		148	
40 M	28		35		202	
20 M	34		32		208	
15 M	44		14		218	
10 M	100		10		229	

Note: end of the roller (max turns clockwise) is 229 = minimum inductance. Maximum inductance is ZERO (0) on the mechanical counter.

6. **POWER ON** The IN position provides power for the Peak and Peak Hold metering circuit, relay and meter illumination.
7. **INDUCTOR** 28 μ H continuously variable ceramic roller inductor driven by a crank handle. Coupled to the crank handle is a gear-driven precision mechanical counter. (Max.= 0; Min. = 229)
8. **OUTPUT** Continuously adjustable output capacitor. Min. capacitance=0. Max capacitance = 100.
9. **DIRECT-TUNED MODE SWITCH** Six-position rotary switch selects an output coaxial connector.
 - a. **DIRECT BYPASS** selects BYPASS COAX connector bypassing the impedance matching circuit but providing SWR, FORWARD and REFLECTED power meter readings.
 - b. **DIRECT COAX 1** selects COAX 1 connector bypassing the tuner matching circuit but providing SWR, FORWARD and REFLECTED meter readings.
 - c. **DIRECT COAX 2** selects COAX 2 connector bypassing the tuner matching circuit but providing SWR, FORWARD and REFLECTED meter readings.
 - d. **TUNED COAX 1** selects COAX 1 connector through the impedance matching T circuit.
 - e. **TUNED COAX 2** selects COAX 2 connector through the impedance matching T circuit.
 - f. **TUNED BAL** selects the END FED WIRE connector through the impedance matching circuit. For balanced antennas, the balanced coax switch (5) must be IN.
10. **INPUT** Continuously adjustable input capacitor. Min. capacitance = 0. Max = 100.

Schematic Diagram

MODEL AT-5K

